The Canadian Drought Outlook Project

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On behalf of the project team

North American Drought Monitor Forum

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Overview

- There are currently no national drought outlook products for Canada
- This is a current gap. It is important for decision-makers, as a want and as a need.
- This project will help address this gap
- Collaborative project – Canada and the US
- 3 years, $85K. Project approval still pending

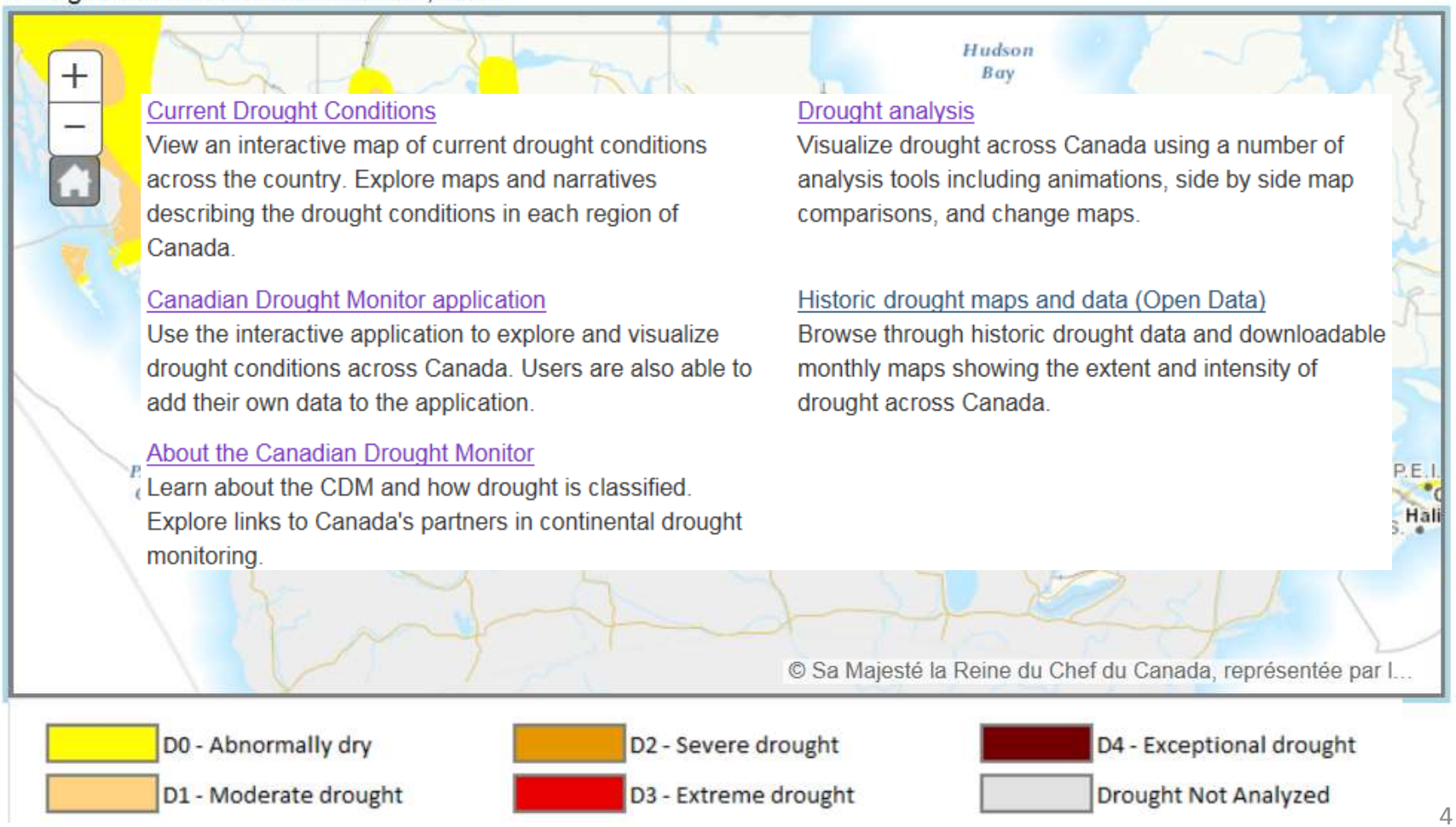
The Rationale for a Drought Outlook

- Need and a want
- Need to better understand and quantify future risk
- Want to help planning and decision support across multiple sectors
- Want to help inform decisions, increase confidence, reduce uncertainty

The Canadian Drought Monitor

www.agr.gc.ca/drought

Drought conditions as of March 31, 2018



Project Approach - Big Picture

EXISTING CDM Assessment Process – multiple indices (AAFC and NRCan), multiple data input, expert review

+ NEW assessment options to test and integrate from ECCC: CaLDAS, CaPA, reanalysis products, VegDRI…

EXISTING U.S. methodology for Drought Outlooks

+ Any recent methodology from other countries?

+ multiple operational forecast options from ECCC: CanSIPS, NNME, GEPS

= NEW Drought Outlook products for Canada

Our Initial Approach

- Use a combination of existing probabilistic and deterministic forecasts of varying duration
- identify areas of potential change by broad categories: improving, worsening, no change
- Proven methodology, with operational precedents, e.g. US Climate Prediction Center
- Very likely adaptable to the Canadian situation given similar geography and climate.

Current US Drought Outlooks

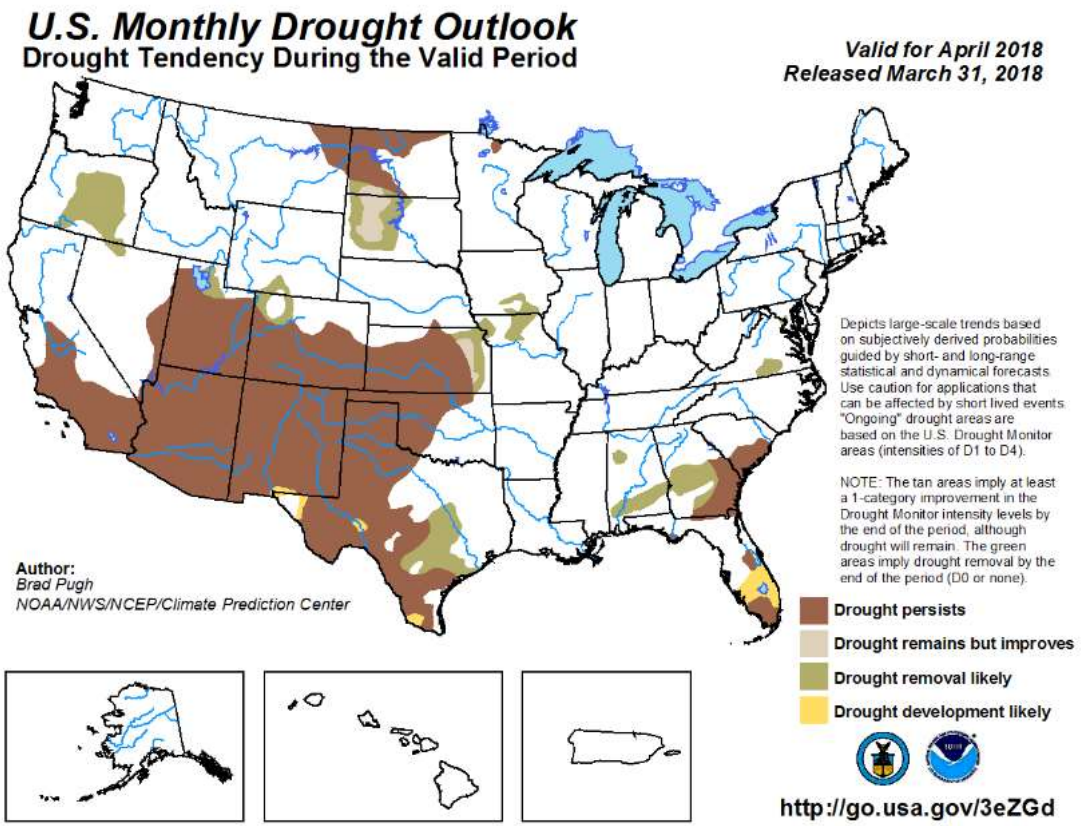
Online at http://droughtmonitor.unl.edu

Select products to display:

- ☐ Climate Outlooks
- ☑ Monthly U.S. Drought Outlook
- ☑ Seasonal U.S. Drought Outlook
- ☐ Streamflow Forecast
- ☐ Soil Moisture Forecasts
- ☐ Current 3- to 7-Day Outlooks
- ☐ Current 6- to 10-day Outlook
- ☐ National Fire Weather Outlook
- ☐ Western Water Supply Outlook

Monthly U.S. Drought Outlook

The latest monthly drought outlook from the Climate Prediction Center



Project Objectives

1 – Develop a model for Canada based on a US example; search for potential improvements to the methodology

2 – Test and validate the model and outputs

3 – Standardize and operationalize the digital map products and post online

Project Methodology

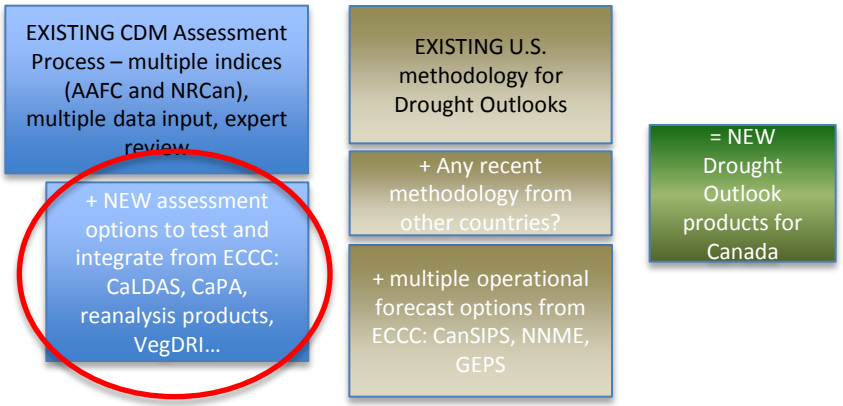
- **Year 1 of 3**, preparation and set-up
- a literature search to determine if there are any recent potential improvements that could be applied to improve the methodology
- develop an initial model with which to provide monthly and seasonal drought outlooks for Canada utilizing current drought assessment methodology and forecast data from ECCC

Project Methodology

- **Year 2 of 3** – The bulk of the work.
- testing and validation of an operational system for creating national drought outlook products, monthly and seasonal, for Canada.
- Improve the model if possible.
- Provide a test Canadian drought outline product online on the AAFC Drought Watch website

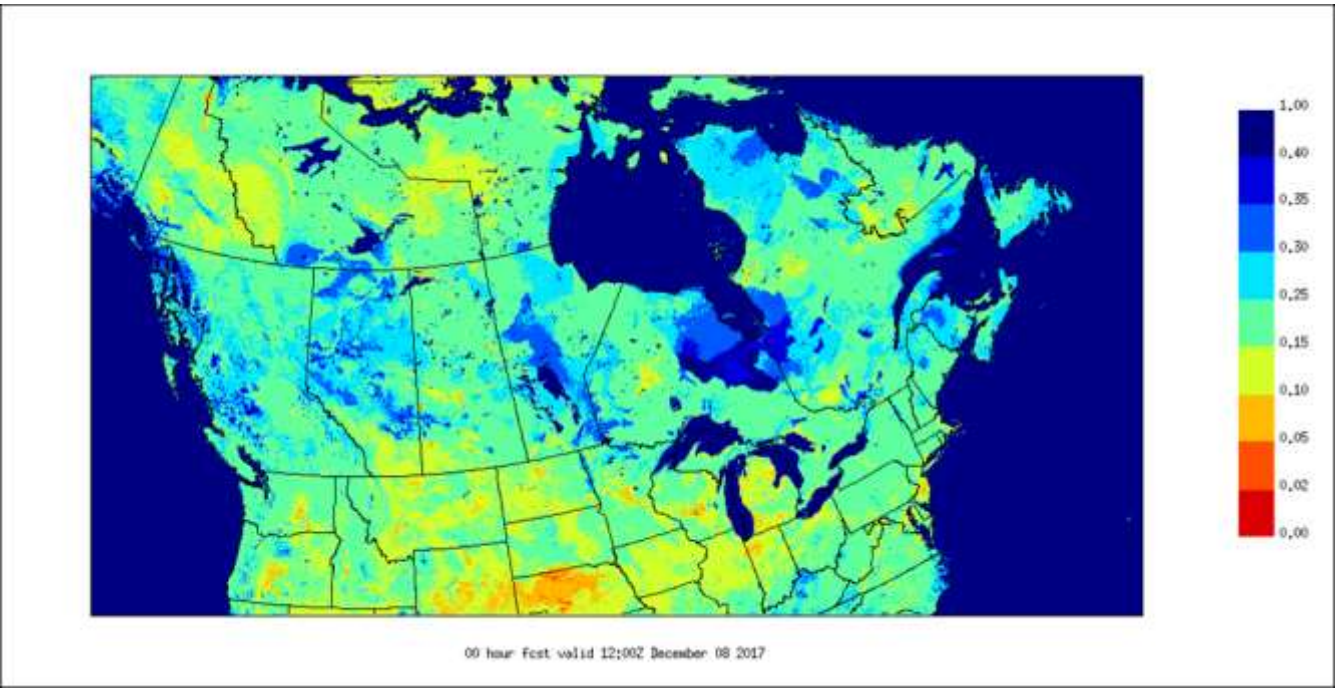
ECCC operational products for existing drought assessment

- The land surface analysis (with CaLDAS) and precipitation analysis (with CaPA) products provide fairly accurate information about soil moisture, temperature and precipitation on a real-time basis.



- These products can be used to complement the existing CDM operational drought monitoring assessments
- The 35-year reanalysis of surface and precipitation can be used for training and validation of the existing drought monitoring assessments and the new outlook models

Canadian Land Data Assimilation System (CaLDAS)



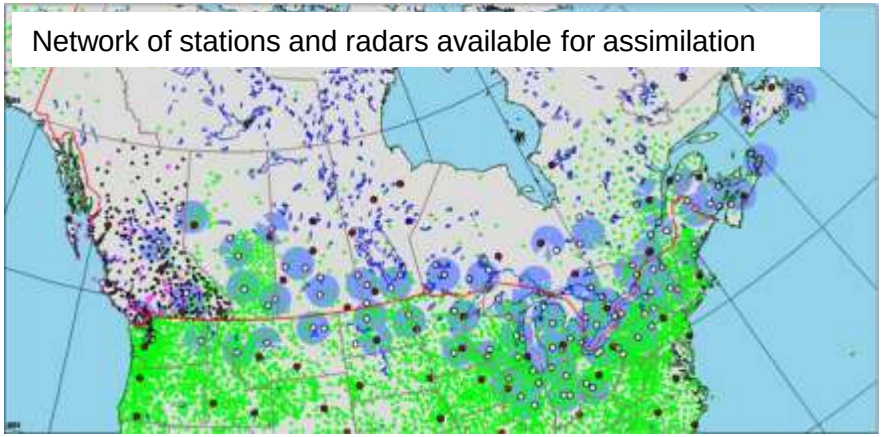
Land-surface variables

- Temperature
- Humidity
- Snow depth
- Surface runoff
- Drainage
- …
- Résolution: 2.5 km
- Fréquence: 1hour

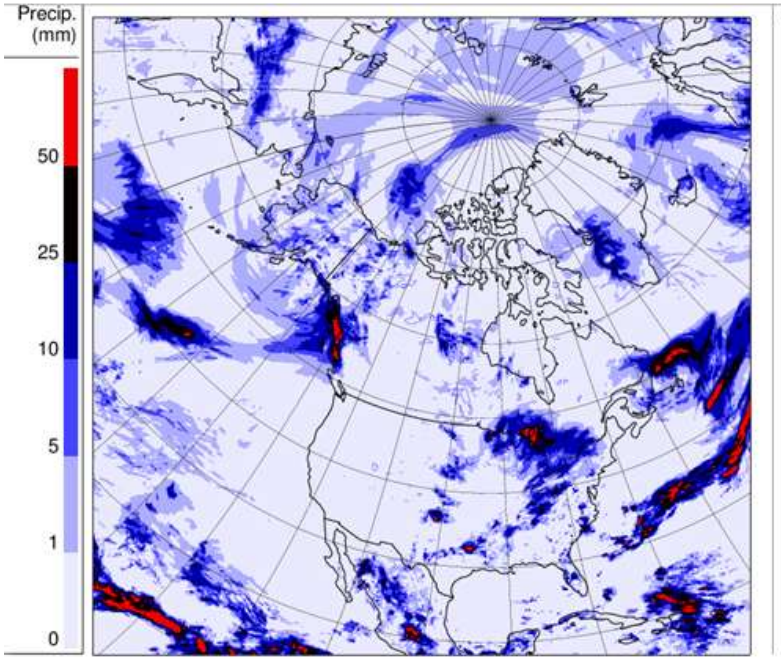
S.Belair and M.Carrera

Canadian Precipitation Analysis (CaPA)

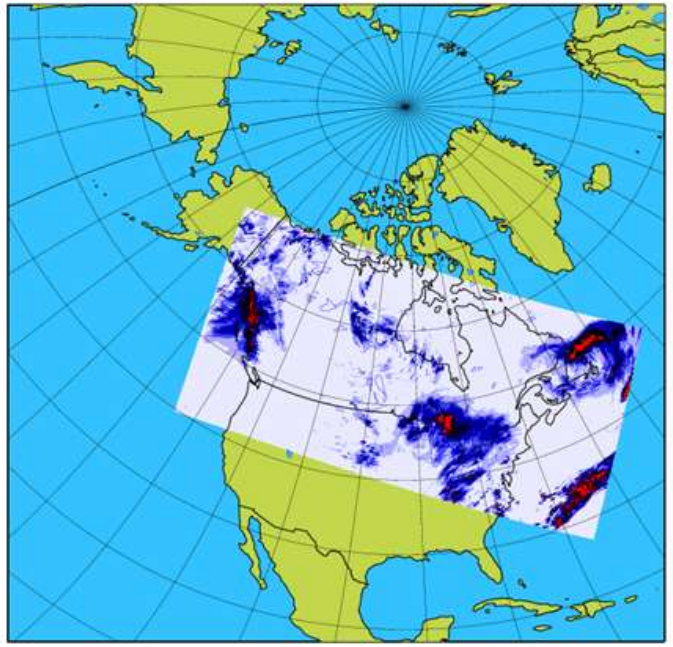
- Precipitation analysis based on observations from stations and Radars
- Multiple resolutions
- Covers all of Canada
- Helps address station gaps



CaPA at 10 km resolution



CaPA at 2.5 km resolution

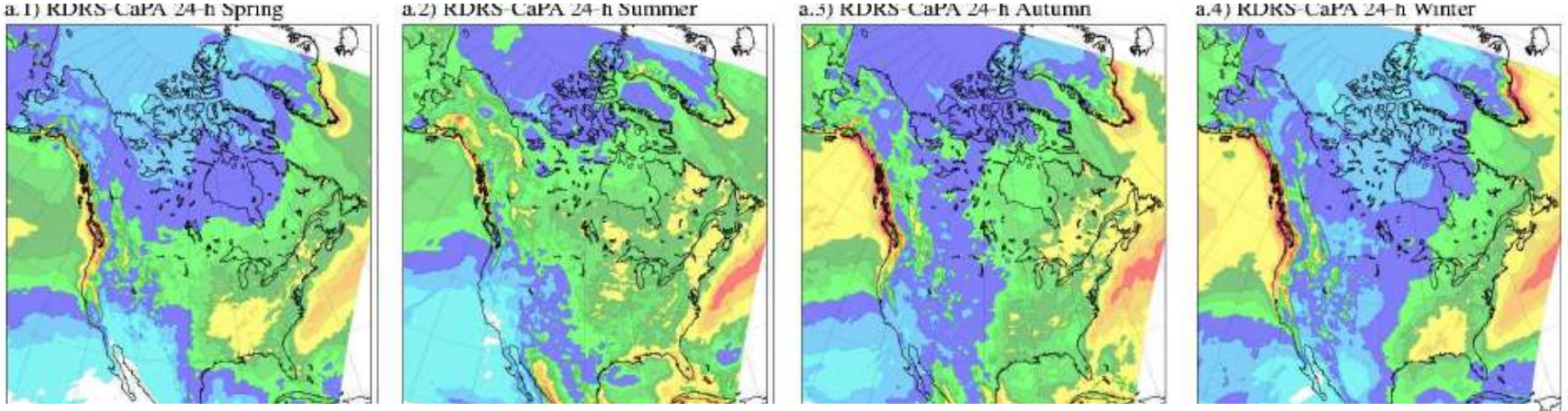


V.Fortin

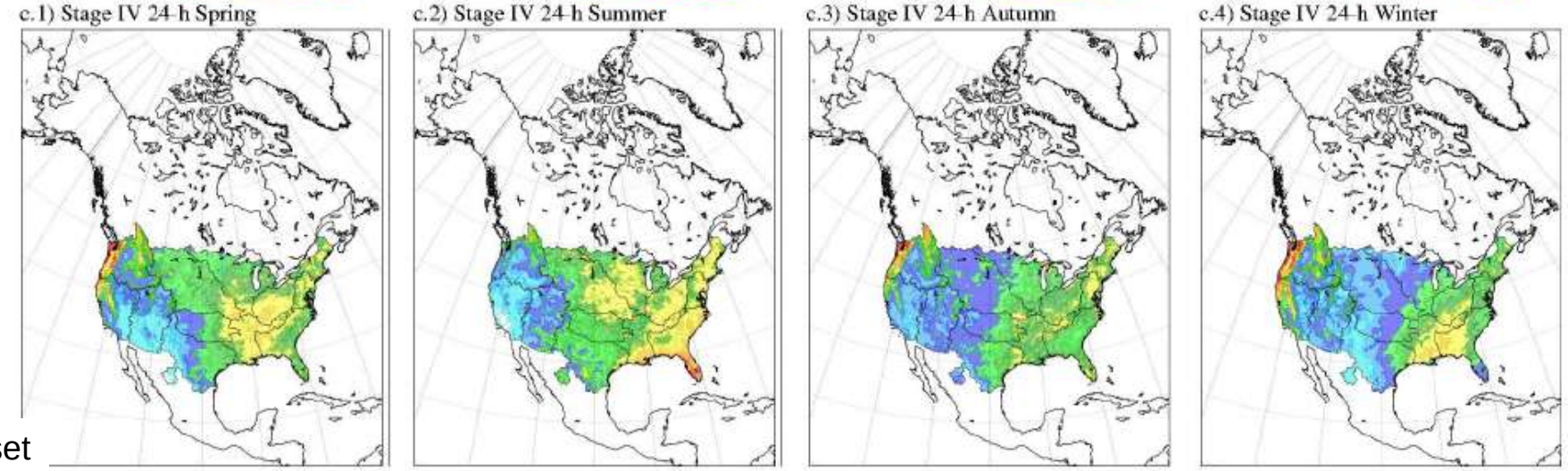
35-year reanalysis of land surface and precipitation:

Seasonal mean of 24-hour accumulation of precipitation

Top row: ECCC reanalysis (15 km resolution)

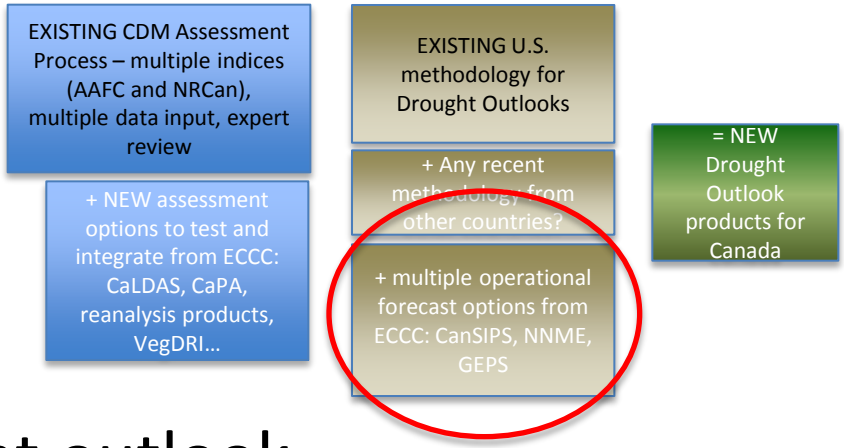


Bottom row: US precipitation analysis (4 km resolution)



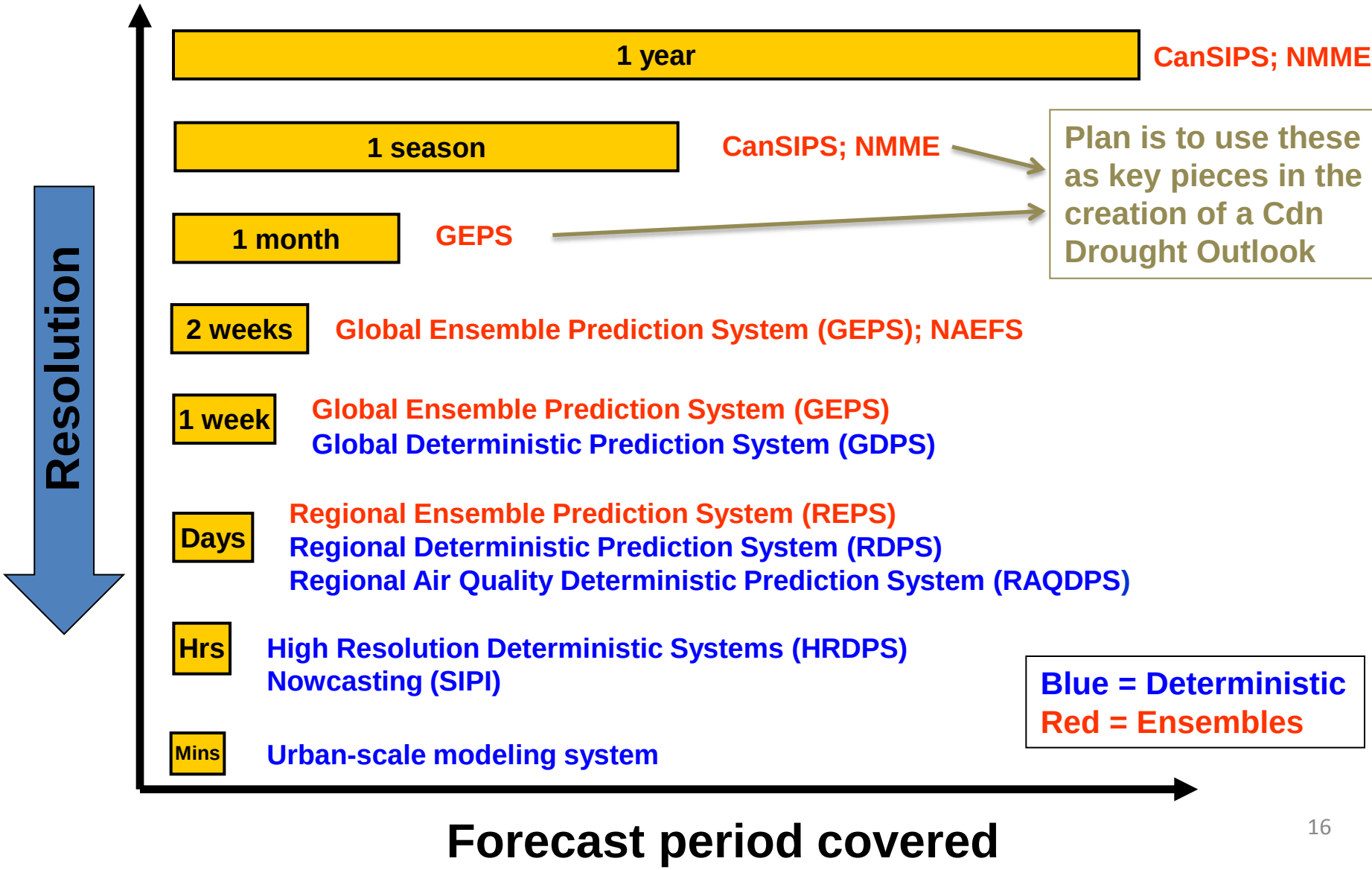
N.Gasset

ECCC operational forecast products



- The bi-weekly and monthly forecasts (with GEPS), and seasonal and inter-seasonal forecasts (with CanSIPS) can be used for the operational drought outlook. NMME products can also be used in R&D and validation of the drought outlook model since CanSIPS is part of the NMME.
- Other short to medium range forecasts (days to 2 weeks, with HRDPS, REPS, GDPS and GEPS) can be used for flash drought onset forecast.

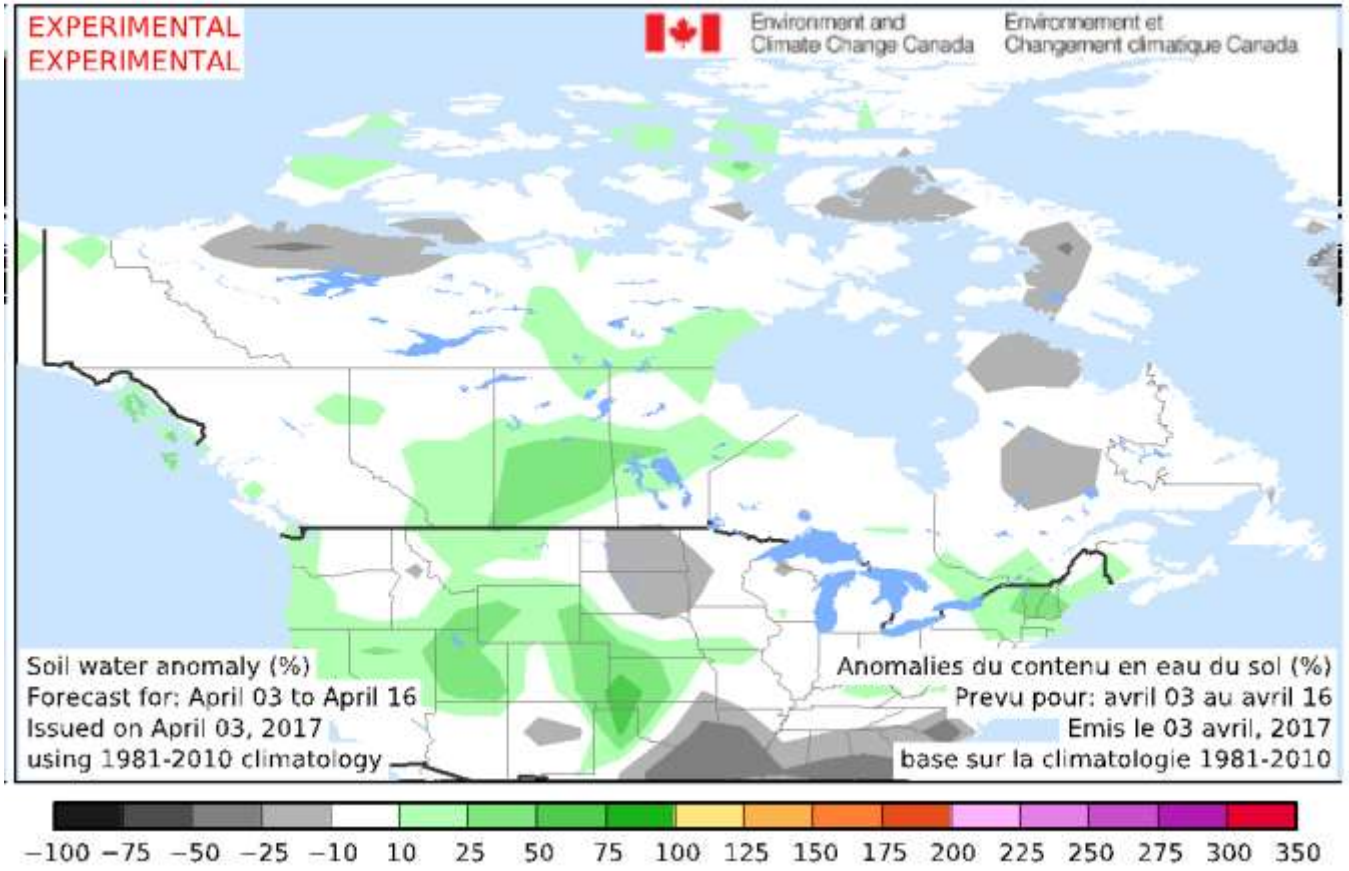
ECCC operational products: Real-time forecasts



CanSIPS: Canadian Seasonal & Inter-seasonal Prediction System

- 250 km horizontal resolution
- Month 1 to 1-year forecasts
- 20 members

- Anomaly forecasts
- 30-year climatology (hindcast): 1980-2010



Liquid and frozen soil water: 0-35 cm (rooting depth)

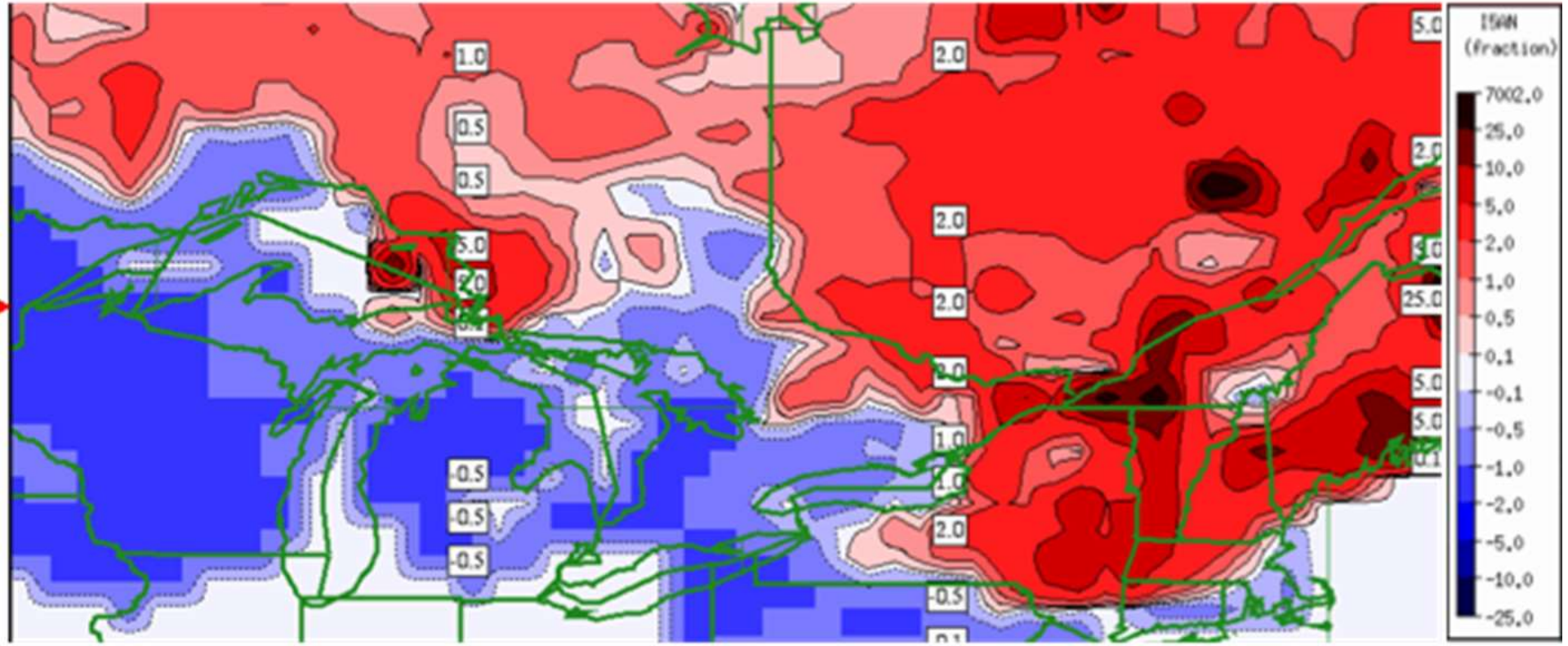
Forecast anomaly averaged over 2 weeks

D.Durnford and M. Markovic

GEPS: Global Ensemble Prediction System

- 50 km horizontal resolution
- 2xdaily 16-day forecasts, and weekly 32-day forecasts
- 20 members

- Anomaly forecasts
- 20-year climatology (hindcasts): 1995–2014
- 4 million observations assimilated daily



Snowpack water equivalent (SWE) forecast anomaly at the end of March, 2017, by D.Durnford and N.Gagnon

Project Methodology

- **Year 3 of 3** – Put operational products online.
- Standardize and operationalize the digital map products. Automate. Static and dynamic map products plus web application and tools. Existing technology.
- Post online to multiple locations, Drought Watch, Open Data and likely the Canada Centre for Climate Services portal.

D

Resources

Resource Name	Resource Type	Format	Language	Links
Canadian Drought Monitor	Application	HTML	English	Access
Monthly Areas of Drought in Canada	Web Service	WMS	English	Access
Monthly areas of drought in Canada	Web Service	ESRI REST	English	Access
Monthly areas of drought in Canada	Web Service	ESRI REST	French	Access
Pre-packaged Maps	Dataset	PDF	English	Access

Drought Watch www.agr.gc.ca/drought

Open Data www.opendata.gc.ca

Canada Centre for Climate Services portal

Summary

- Drought outlook products will be of interest and use to a wide variety of clients
- The project has garnered very good interest
- Work will be done with an eye to enabling integration between Canada and U.S. drought outlook products a la NADM
- Products will be digital, machine readable, and shared online